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ABSTRACT

Two studies examined children's first references to the mental states of perception, desire, and belief in themselves and others. In Study 1, children interacted with their mothers in a laboratory setting at 14, 20, and 32 months of age (n=52); in Study 2, children were observed in their homes at 3-month intervals from 18 to 42 months (n=32). Results showed three stages of acquisition, with about a year's delay between each stage. In Stage 1, children acquired the forms for expressing others' perceptions and their own desires. In Stage 2, they began referring to their own perceptions, their own beliefs, and others' desires. In Stage 3, they referred to others' beliefs. There was no general bias toward talking about the self with these mental state verbs, nor any evidence of self-bias in subsequent analyses of children's use of action verbs. Children were not simply mimicking others' use of self and other with mental states. Results pose implications in terms of problems presented for theories regarding how children acquire their first understanding of the mind, theory building versus introspection, and simulation. (Contains 26 references.) (Author/KB)

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Perception, Desire, and Belief in Me and You:

Young Children's Reference to Mental States in Self and Others

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Abstract

Two studies examined children's first references to the mental states of perception, desire and belief in themselves and others. In Study 1 children interacted with their mothers in a laboratory setting at 14, 20 and 32 months of age (n=52) and in Study 2 children were observed in their homes at three-month intervals from 18-42 months of age (n=32). Results showed three stages of acquisition. In the first stage children acquired the forms for expressing other people's perceptions and their own desires. In the second stage they began referring to their own perceptions and their own beliefs and others' desires. In the third stage they referred to others' beliefs. There appears to be about a year's delay between each stage. There was no general bias toward talking about the self with these mental state verbs, nor was there any evidence of self-bias in subsequent analyses of children's use of action verbs. Furthermore children were not simply mimicking others' use of self and other with mental states. Results are discussed in terms of the problems these data present for both of the dominant accounts of how children acquire their first understanding of the mind: theory theory which holds that this is a process of theory building, and simulation theory which holds that it is a process of introspection and simulation. We suggest (a) that references to others' perceptions may stem from children's early ability to interpret others' behavior intentionally, (b) that references to self desires, perceptions, and beliefs stem from direct introspective access to those states, and (c) that references to others' desires and beliefs may result from simulation or, more likely, may represent children's earliest construction of theoretical concepts of mental states.

Perception, Desire, and Belief in Me and You:

Young Children's Reference to Mental States in Self and Others

While mental life is truly unobservable, the language that we use to express mental states can be viewed as an important indicator of our understanding of those states. We do not simply experience our own mental states, or infer mental states from people's behaviors, and stop there. We also give voice to our experiences and inferences, ascribing a rich mental life to both ourselves and to others around us. We rarely hear people make exclusively declarative statements about their own or others' actions. Rather than simply stating that we are going to see a movie, buy a car, or move to a new house we talk about wanting to see a movie, wishing to buy a new car and desiring a new home. Rather than simply stating states of affairs in the world, we refer to our own and others' perceptions of those states of affairs, and to thinking, knowing, and believing those states. Mental state vocabulary is used to relate the propositional attitude of the speaker, and language therefore offers a unique opportunity to gain insights into how individuals understand their own and others' mental lives.

The process by which children come to first understand their own and others' mental lives has become a fiercely contested topic. Among current theories regarding the nature of this process simulation theory and theory theory have become predominant. Simulation theory is based upon the idea that children first identify their own mental states and then generalize these mental states to other people through a process of simulation. Theory theory is founded on the premise that children construct a theory of mental states that pertains to all people, themselves included. Children use this theory about mental life to explain and predict behaviors, using concepts such as perception, desire and belief as causal explanations for motivation.

Simulation theory begins with the premise that we have privileged access to our own inner mental life (Harris, 1992; Goldman, 1992, 1993). According to simulation theory, the ability to

introspect on our own mental states is the basis by which a child interprets and understands others' behaviors and mental life. Essentially, the child puts him or herself in the place of another, vicariously experiences the mental state that other person experiences, and then attributes that mental state to the other person. To be successful in simulating another person's mental state, one must not only engage in the pretense of being in another's situation, but must also engage in the pretense of being the other (Gordon, 1986). This means that one must take account of personal differences when simulating the situation of another in order to be successful at predicting the mental state outcome. For example, errors in attributing mental states in others should show a bias towards not recognizing personal differences between the self and the other. Thus, a successful simulation gives rise, in the person simulating, to the mental state experienced by the person being simulated. The act of simulation does not use theoretical knowledge at the most basic level, but rather it is an act of pretense in which the simulator comes to directly experience and introspect upon the outcome mental state.

A basic assumption of the theory theory approach is that children do not have privileged self-knowledge of their own mental states; rather, children build a theory of mental life that applies as equally to their own minds as to those of others (Gopnik, 1993). Evidence supporting the theory-theory position comes from experimental studies showing that young children fail to understand their own beliefs as well as those of others (Gopnik & Astington, 1988). For example, children were asked to name the contents of a smarties sweet box and then were shown that the box contained pencils (contrary to their expectations). When asked what another child would think was in the box children younger than four years of age claimed that the other child would think pencils were in the box; thus they failed to understand that the other child would have a false belief. Importantly for theory theory, these children fared no better when asked what they themselves first believed was in the candy box. The majority of these children responded by saying

pencils. Results of these studies and similar results obtained with studies that present children with an unexpected transfer task (Wimmer & Perner, 1983) have been cited to suggest that children do not begin their process of understanding the mind with any privileged access to their own mental states.

Simulation theorists have argued that these results only show that reference to past mental states in the self also requires simulation. Thus children should not demonstrate an understanding of past mental states in the self any sooner than they demonstrate an understanding of mental states in others (Harris, 1993). Simulation theorists argue that these studies do not rule out the possibility that children may be able to introspect on their own current mental states sooner than they can talk either about their own past mental states or others' mental states. Unfortunately, few studies have experimentally tested children's ability to introspect on their own current mental states (Harris, 1993).

Evidence from children's language production, however, can be used to evaluate the predictions of simulation theory and theory theory regarding whether children begin their understanding of the mind with introspective access to their own mental states. Wellman and Bartsch (1994) and Bartsch and Wellman (1995) have recently taken this approach in studies of the everyday talk of 10 children aged between two and five years. They found, for example, that children consistently began talking about their own desires before their own beliefs. They argued that this was a difficult problem for simulation theory because if children had introspective access to their own desires, they should have similar access to their own beliefs. They also found, however, that children used mental state verbs in reference to themselves before they used them in reference to others. This finding would appear to support simulation theory by suggesting that children have an understanding of their own minds before they have an understanding of others. Bartsch and Wellman (1995) respond to this conundrum for theory theory by reporting that the

average delay between first reference to desire and belief in self and first reference to desire and belief in others was at most three months--too brief, they argued, for children to have gone from introspecting their own mental states to simulating those mental states in others. Bartsch and Wellman acknowledge that their estimated length of delay between self and other reference to desires is inconclusive because of the small number of children for whom they have data at a young age. In other words, several of their children were already referring to self desire when they entered the study, making it impossible to know when they began.

Nevertheless, Bartsch and Wellman argued that any delay is simply due to the fact that children prefer to talk about themselves rather than others. There is some other evidence that makes this a reasonable possibility. First, Imbens-Bailey and Pan (In press) recently examined children's acquisition of personal pronouns. Whereas Bartsch and Wellman (1995) culled children's language for use of mental state verbs, and then within that subset of utterances determined the relative frequency of references to self and other, Imbens-Bailey and Pan culled children's language for explicit use of the personal pronouns I and you. They found that at 20 and 32 months of age children used I much more frequently than you not only in reference to mental states but in other contexts as well. In addition, when children used I, it was most often in the context of expressing their wants and desires. They argued that use of I in this context would serve to disambiguate and highlight the child's desires and that there were likely to be compelling pragmatic reasons for why children would be more likely to explicitly mark their own desires rather than others' desires.

Second, studies of the order of acquisition of personal pronouns have found that in general children acquire the first person singular pronoun sooner than either second or third person pronouns (e.g., Bretherton, McNew & Beeghly-Smith, 1981). From this, researchers have concluded that second and third person pronouns are linguistically more complex. Thus, any delay

between children's linguistic expression of mental states in self and others may be related to pragmatic and linguistic factors impacting the acquisition of the pronoun system, and not to children's lack of understanding of mental states in others.

In the present two studies of natural language data collected from young children in interactions with parents and others, we focused on the delay between reference to self and other with mental state terms. We extend the existing research on children's spontaneous linguistic expression of mental states in the following three ways. First, we conducted longitudinal analysis of the acquisition and referents of mental state terms with larger samples in order to attempt a replication of the findings of Bartsch and Wellman's (1995) small scale studies showing a short delay between self and other reference. Second, we investigated the claim by Bartsch and Wellman (1995) that young children simply prefer to refer to themselves by conducting a comparative analysis of reference to self and other with action verbs. In both cases we followed Bartsch and Wellman in determining self and other reference not only from children's explicit pronoun use, but more broadly from the immediate proceeding and subsequent contexts of children's utterances when they omitted personal pronouns. Third, we investigated the possibility that parent input may influence child production of mental state verbs. For instance, children may simply imitate parent reference to self and other in their use of mental state terms, or parents may be priming the children's use of these verbs. In a study of the frequency and functions of mental terms in the speech of mothers to their children, Furrow, Moore, Davidge and Chiasson (1992) found that not only was maternal frequency of mental terms when children were two years old related to children's frequency of terms at three years, but also that maternal mental state terms that functioned to reference genuine internal states or required the children to reflect upon a statement when they were two years old predicted children's use of mental state terms at three years. They argued that these findings suggest that a theory of mind is fostered by the type of

linguistic environment to which children are exposed. In the current studies we extended this line of research to determine if there is an association between parents' and children's reference to mental states in self and others.

Study 1

Method

Participants. Participants were the children and parents of 52 families who comprise the New England corpus of the Child Language Data Exchange System (see Snow, Pan, Imbens-Bailey, & Herman, 1996; Pan, Imbens-Bailey, Winner, & Snow, 1996, for description of subject recruitment). Background and language information about the sample is presented in Table 1. It should be noted that attrition of the sample at the 20 and 32 months observations did not notably affect the composition of the sample.

Procedure. Archival transcripts were available of verbatim parent-child interaction. Dyads were videotaped in a laboratory playroom when children were 14 months, 20 months and 32 months old. With the exception of two occasions when fathers accompanied a child, all dyads were mother-child pairs. Transcripts at 14 and 20 months reflect spontaneous language data collected during five minutes of free-play and subsequent play using the contents of four boxes: first a ball, then a cloth for peekaboo, next paper and crayons, and finally a book. Parents were not instructed on the duration of each activity, but were asked to have only one box open at a time, and to try to use all four boxes in about 10 minutes. Sessions were terminated only when the parent had tried to engage the child in all four activities. This protocol led to variation in the duration of the videotaped session, ranging from 10 to 25 minutes. The protocol for parent-child interaction at age 32 months also involved contents of four boxes (a picture book, crayons and paper, hand puppets, and a toy house), with no preceding warm-up period.

Coding and Data Analysis. All automated analyses of transcripts were conducted using computer programs of the Child Language Data Exchange System (MacWhinney & Snow, 1985, 1990; MacWhinney, 1991). Data were coded following the general coding procedures for mental state verbs outlined in Bartsch and Wellman (1995). However, several modifications were made to this procedure in the current study. Five additional verbs not among those desire and belief terms analyzed by Bartsch and Wellman (1995) appeared in our children's transcripts so we included them in analysis (see Appendix A). In addition, we coded referents for perception and action verbs that were used with a frequency of ten and above at one or more observation points. These criteria resulted in the inclusion of two perception verbs (see and look) and several action verbs (see Appendix B).

Using CHILDES programs, we used a window of eight utterances centered on the utterance that included the target verb in order to include context in coding decisions. In the current study, utterances by children and parents that included perception, desire and belief verbs were coded at two distinct levels:

(1) Genuine use of a mental state verb (i.e., unambiguously used for mentalistic rather than conversational purposes). For example, the use of "I don't know" was coded as genuine use of a mental state verb only if the context suggested the child was referring to the state of their own knowledge as in the following exchange: Mother: "What's he [a character in a book] putting on?" Child: "I don't know," whereas the use of know as conversational or attention getting device (e.g., "You know what?") was excluded. Regarding perception verbs, idiomatic uses (e.g., "see you" to mean good-bye), and uses of "look" with regards to appearance (e.g., "looks like mine"), were also excluded.

(2) Referent of any genuine mental state verb; (a) Self (i.e., own mental states, for example "I want to play", "I think he is bad"), (b) Other(s) (i.e., others' mental states, for

example "You want to play?" "He thinks it is a car"), or (c) Joint (i.e., shared mental states, for example "We wanted the television on", "We think he is hiding"). If the child did not use a personal pronoun, the reference for the verb was determined from the context, if possible. Appendix C gives full details of the coding scheme as presented to the coders. Utterances by children that contained an action verb were simply coded for referent (i.e., self, other(s) or joint), excluding all ambiguous uses. Imperatives that did not contain a pronoun (e.g., "come here") were coded as other reference.[1]

Reliability was determined between two coders for eight (15%) of the transcripts at 14 months. Due to attrition at the subsequent observation points, eight transcripts constitute a higher percentage of transcripts double coded for reliability purposes (17% and 25% at 20 and 32 months, respectively). For the purposes of calculating reliability on children's mental state verbs, data from all observation points were combined due to infrequent mental verb usage at 14 months and 20 months. Simple interrater agreement for identifying genuine use and referents of the children's mental state verbs was .92 . Cohen's kappa, which takes account of chance agreement between coders, was .68. Simple agreement on referents in children's action verb usage was .86, .84, and .83 at 14, 20, and 32 months respectively (kappas of .73, .76, and .76 respectively). Reliability between two coders for identifying genuine usage and referent of parents' mental state verb usage was .99, .98, and .99 at each of the respective time points (kappas of .97, .96, and .99 respectively).

Results

Reference to perception desire and belief. Table 2 shows the total number of instances of verbs of perception, desire and belief at 14, 20 and 32 months by type of reference (i.e.,

self, joint or other), in addition to the number of children who produced each type of verb. Only one verb of perception (see) was used by a single child at 14 months. This verb functioned as a request for the mother to see what the child was doing. Much as Bartsch & Wellman (1995) reported, we found that the production of desire verbs preceded that of belief verbs. At 14 months, only one child produced a single linguistic expression of desire by referring to his own wants. No child was using verbs of belief at 14 months. At 20 months, children produced a total of 18 perception verbs (predominantly see), 60 instances of desire, (almost exclusively using want), and three references to belief (all with know). At 32 months, children produced 66 perception verbs, 164 expressions of desire, again predominantly using the verb want, and 62 expressions of belief (predominantly don't know).

At 20 months, the first observation point for which we have a substantial number of children talking about perception and desire, we found that children predominantly referred to their own perceptions with simple utterances such as "I see". Overall, seventy-two percent of perception verbs at this age were to the child's own perception, 17% referred to the other's perception (e.g., "see mommy"), and 11% referred to joint perception (e.g., "let's see it"). At 20 months, children almost exclusively referred to their own desires. Ninety-seven percent of children's references to desire at this age were to their own. They expressed their own desires at this age with utterances such as "I wanna play a game" and "I need blue" (in regard to the color of a crayon). Of the three instances of belief expressed at 20 months all referred to the child's own knowledge state.

By 32 months, children were predominantly talking about others' perceptions rather than their own. For example, children directed the others' attention with questions such as "see that mommy?" or with imperatives such as "mommy look". Overall, 77% of perception verbs

were to others' perceptions, 15% referred to the children's own perceptions, and 8% referred to joint perceptions. In contrast to this change of reference for perception verbs, children still predominantly referred to their own desires at 32 months. Seventy-one percent of their references to desire were in regard to their own desires, 28% referred to the desires of others, either the addressee (e.g., "You want to open it mommy?") or a third person (e.g., "He wants to go in the garage"), and the remaining 1% referred to joint desires (e.g., "We don't want that now."). By 32 months, when belief verbs have begun to appear in the language of a more substantial number of children they show the same pattern of primary reference to self as we found with desire verbs. Ninety-six percent of their references to belief were in regard to their own beliefs (e.g., "I know what's wrong with that," "I think this goes with the chair"), 2% were references to joint beliefs (e.g., "We think doggies like people"), and 2% were references to others' beliefs (e.g., "You know why?"). Thirteen of the 22 children (59%) who expressed belief at this stage did so exclusively in the form of "I don't know" used in response to the parents' requests for information.

Delay between reference to mental states in self and others. In this section we will limit our discussion to delays between reference to desires in the self and in others due to the insufficient numbers of children who produced perception and belief verbs at 20 months. Although at both ages reference to self-desire was more frequent than other-desire, it still could be the case that children produced a few references to other desire at about the same time as references to self desire. Therefore, we looked at the number of children who referred to self desire at 20 months but did not refer to other desire at 32 months. Table 3 shows the use of desire verbs for self and for other for the 36 children for whom we have data at both 20 and 32 month observations. Looking specifically at the 12 children who refer only to their own

desires at 20 months, we find that six (50%) of these children continue to refer only to their own desires a year later.

Importantly, the data in Table 3 suggest low rates of false negatives, in the sense of failure to observe forms that children are genuinely capable of producing. The marginal totals in Table 3 show clearly that references to self desire preceded other desire, and so false negatives would be suggested by the extent to which we found either instances of the reverse ordering or instances of references to self desire dropping out at 32 months. Cells of Table 3 labeled (a) reflect other desire occurring before self desire, and cells labeled (b) reflect self desire at 20 months but not at 32 months. Only one child was observed to refer to other at 20 months without a reference to self, and only one child referred to self at 20 months but did not refer to self at 32 months.

Is reference to self symptomatic of a general preference? At 20 months, children referred to self more frequently than other for perception, desire and belief verbs (see Table 2). Although this was reversed for perception verbs at 32 months, we investigated whether greater use of self reference than other reference may reflect a general tendency to talk about the self as suggested by Bartsch and Wellman (1995). To address this question, we examined action verbs such as put, go and play (see Appendix B). Table 4 indicates few instances at 14 months, but at 20 months children are referring to self and other equally frequently, and by 32 months children are talking predominantly about others' actions. In fact, at 32 months reference to self and other with action verbs is the mirror image of self and other usage with desire and belief verbs. Children are clearly able to talk about others; therefore, the restriction of children's expression of belief and desire states to their own mental life does not seem to be related to a general preference to talk about the self.

Parental input for perception, desire and belief verbs. We analyzed parental reference

to perception, desire and belief in themselves and in others for a potential explanation of the use of these mental states in children. The data show that children were not simply imitating adults. We found that from 14 months on, children were hearing parents use perception, desire and belief verbs (see Table 5). Parents as a group produced 3204 perception utterances containing either the verb see or look when their children were 14 months old, 2548 utterances at 20 months, and 1518 utterances at 32 months. At all three time points parents were almost exclusively referring to other people's perceptions. Reference to joint perception accounted for no more than 10% of perception verb use at all three time points. Reference to own perceptions was the most infrequent at all time points (accounting for no more than 5% at any one time point).

Parents as a group produced 849 utterances containing desire verbs when their children were 14 months old, 935 utterances at 20 months, and 409 utterances at 32 months. In their use of desire verbs, parents were predominantly referring to other's desires, specifically the child's wants and needs (e.g., "What do you want to see?"). In fact, more than 90% of desire verbs used by parents was in reference to others' desires at each observation point. As a group, parents produced fewer verbs of belief (205, 315, and 358 at 14, 20, and 32 months respectively) and the distribution was more evenly divided between references to self (e.g., "I don't know what an opossum says, but I don't think it says that.") and references to others (e.g., "She thinks it is boring."). Thus, while parents tended to refer to other's perceptions, others' desires, and both self and others' beliefs, children instead referred to other's perceptions, self desires, and self beliefs.

Discussion

At 20 months, children almost exclusively referred to their own desires rather than others' desires, and predominantly did so by 32 months. By this later period, verbs of

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perception and belief had begun to appear with some frequency. Belief verbs showed the same pattern of primary reference to self, while perception verbs were primarily used to refer to others' perceptions. Children's preference for self reference with belief and desire could not be explained by their having a general preference for talking about themselves or linguistic difficulty in talking about others, because they did not show the same preference in regard to perception verbs. Furthermore, action verbs were more equally distributed between self and other at 20 months, and by 32 months they were used predominantly to refer to other's actions. We also found that children did not simply repeat the forms they heard their parents saying. Parents almost exclusively referred to other's desires and perceptions, but referred to both self and other belief.

It seems difficult to reconcile these findings with the theory theory explanation of children's developing theory of mind. Theory theory would predict that children construct mental state concepts to explain their own as well as others' behaviors. We should then see children using these concepts for self and other at about the same time. The data, however, indicate a strong tendency for children to talk about their own desires and beliefs, a tendency that cannot be explained as a general preference to talk about themselves (Bartsch and Wellman, 1995). From the current data, it looks as if a reasonable proportion of children show at least a 12 month delay between first reference to their own desires by 20 months and first reference to others' desires. Even if there are pragmatic reasons why children would talk more about their own desires than those of others', a years delay seems too long to be reasonably explained solely on that basis. By 20 months, only three children had expressed belief for themselves and thus any meaningful estimation of the delay between self and other for this particular mental state was not possible. A similar problem existed in estimating the delay for perception, although the data suggested that the developmental pattern might be

reversed, with other reference preceding self reference.

Our finding that children's talk about their own mental states cannot be explained by imitation of the parental input, is somewhat at odds with a study by Furrow et al., (1992) who found that child use of mental terms mirrored that of their parents. While Furrow et al., (1992) did not examine the referents of mental state verbs, one might still have expected a similar mirroring of parental use of referents for mental state terms by the children in the current study. However, there was no simple relationship between parent input and child output in our study. Parents talked almost exclusively about the child's desires and perceptions, but they talked about their own and the child's beliefs in equal proportions. Parents may label children's implicit verbal (i.e., "give me teddy") and non-verbal (i.e., pointing, reaching, or crying for an object) expressions of desire with desire verbs such as want (i.e., "oh, you want the teddy, do you?)". They may similarly label the child's gaze (i.e., "do you see teddy?). In the case of belief, parent interaction may differ because the child's belief states may be less salient to parents and cannot be readily labeled in the manner that desires and perceptions can be.

Bartsch and Wellman (1995) had used their evidence of relatively short delays of at most three months between appearance of self and other reference for desire and belief verbs as an important part of their argument that children construct a theory of the concepts desire and belief to explain their own and others behaviors, rather than beginning with first person experience of desire and belief. In the larger data set examined here, a substantial proportion of children showed at least a year's delay between first reference to self and first reference to other desire. In Study 2 we examined data from a large scale longitudinal study in which children's language was collected at frequent intervals from age 18 months to 42 months. Such a study allowed us to more clearly ascertain the length of delay between self and other

reference for all three types of mental states.

Study 2

This study serves as a replication and extension of Study 1. The sample consists of 32 children sampled in their homes at 3 month intervals from the age of 18 months to 42 months. This study was designed to overcome several potential criticisms regarding the data from Study 1. First, having only three data points in Study 1 made the developmental picture incomplete. Second, relying on parent-child interaction in the laboratory playroom in Study 1 may have been unusual in its exclusive focus on the child and his/her actions. Last, the lexical expression of belief had been largely absent from the lexicons of the relatively younger children of Study 1.

Method

Participants. Participants were the 32 children and their families who comprised the Wells corpus of CHILDES (see Wells, 1981, for description of subject recruitment and fuller details of data collection techniques). Children were being raised in Bristol, England and were observed between 18 and 42 months of age. There was a linear increase with age for Mean Length of Utterance for the group, from 1.42 morphemes per utterance at the outset of the study to 3.12 at the 42 month observation.

Procedure. Archival verbatim transcripts of the children interacting with parents and others with whom they came into contact were utilized. Wearing a radio activated microphone pack the children had been audiotaped throughout the day at regular intervals of 90 seconds every 20 minutes. The first taped interaction took place when the child was about 18 months and was repeated at 3 month intervals until the child was approximately 42 months. This procedure resulted in 9 data points over a two year period, each approximately 40 minutes in duration. The contexts of each 90 second session of interaction were determined by the original data collectors by debriefing the children's parents at the close of a day's audiotaping.

Coding and Data Analysis. Coding and analyses were conducted on transcripts available from CHILDES. The same procedures for coding mental state verbs in Study 1 were used in this subsequent study. However, due to the quantity of data produced over nine observation points, only the three most frequent action verbs (go, do and put) and the two most frequent verbs of perception (see and look) were analyzed in this second study.

Reliability between two coders for identifying genuine usage and referent in children's desire and belief verbs was calculated on five (16%) child transcripts at each of the nine observation points and on an additional five child transcripts for identifying person in action and perception verbs at each observation point. Simple interrater agreement for desire and belief verbs ranged from .85 to .95 across transcripts. Cohen's kappa (which takes account of chance agreement between coders) ranged from .78 to .92. Simple interrater agreement for action and perception verbs ranged from .81 to .97. Cohen's kappa for these verbs ranged from .75 to .96.

Results

Reference to perception, desire and belief. Table 6 shows that the number of children using verbs of perception, desire and belief increases with age, as does the absolute frequency of occurrences. Study 2 provided much more detail as to the age of acquisition of the different mental state verbs when compared to Study 1, however the proportion of children who used mental states at each time point was generally similar to Study 1, as was the earlier reference to desire rather than to belief. Perception verbs were initially used to refer to other's perceptions, which replicates the pattern we found at 32 months for perception verbs in Study 1.

Delay between reference to self and others in verbs of perception, desire and belief. We looked specifically at the onsets of self reference and other reference in verbs of perception, desire and belief. Figure 1 shows the cumulative percentage of children with onsets of self and other perception, self and other desire, and self and other belief at each time point. These data clearly

show substantial delays of onset for referring to others' desires and beliefs. From Figure 1 we see that the typical delay between onset of self reference and onset of other reference was approximately 12 months for desire and 11 months for belief. For example, at 21 months 44% of the children had used self desire, but it was not until 33 months that approximately the same percentage of children (47%) used other desire. At 30 months 38% of children had used self belief, but it was not until sometime between 39 and 42 months that the equivalent percentage had used other belief.

The question of whether or not the group trends are representative of individual trends was explored by examining the delay patterns on an individual basis. All 32 children used desire vocabulary in reference to self at least one time point prior to using desire vocabulary in reference to other (see Table 7). Seven of the children had not used desire vocabulary in reference to other by the final 42 month time point. We could estimate the minimum delay for these seven children by assuming they would have referred to other's desires by the next time point (45 months) had the study continued. These estimated minimum delays were distributed similarly to the observed delays, with most falling within the range of 6- to 21-month delays.

Table 8 shows the individual patterns of acquisition for belief verb usage. Three children showed reversals of the typical ordering, with use of belief vocabulary for other at least one time point prior to use of belief vocabulary in reference to self. One child showed simultaneous onset of belief in reference to self and other. Twenty-four of the 32 children used belief vocabulary in reference to self at least one time point before reference to other. Fourteen of these children had not used belief vocabulary in reference to other by 42 months, but their estimated minimum delays fell mostly within the range of 6- to 21-month delays rather than within the shorter delays. (Four children did not use any belief vocabulary during the study). Thus, in contrast to the individual patterns of acquisition for desire, four children showed either reversed or simultaneous acquisition

of self and other reference for belief, but the majority showed the same types of delays as with desire.

From Figure 1 we also see that the six forms of mental states appear to be grouped in three distinct onset patterns. In the first stage of onset, other perception and self desire were expressed. In a second stage, self perception, self belief and other desire followed very similar trends of onset. In a third and final stage, other belief was beginning to be expressed by some of the children. These group patterns were confirmed by the individual data, that showed 25 (78%) of the children expressed perception, desire and belief for self and other in the same rank order of the three stages already outlined. The seven children who did not follow the group trends had onsets for other belief (third stage) that were earlier than onsets for one or two of the three second stage forms (i.e., other belief before self perception, self belief, and/or other desire).

Is reference to self symptomatic of a general preference? Children's use of action verbs was also examined. The nine observation points were collapsed into three time periods: 18-24 months, 27- 33 months, and 36- 42 months. Table 9 shows the number and percentages of verbs used to refer to self, others or to both self and other (joint) at each period for action verbs. For action verbs at all periods, the majority of verbs were used to refer to others (e.g., "You put it on the chair"). The ratio of self to other reference stayed constant across time periods. The ratio was approximately one self reference to two other references. Joint reference to actions was completely absent between 18-24 months and was seldom used at later time points.

Discussion

Results of Study 2 confirmed the suggestion from Study 1 that substantial delays exist between onset of first reference to self and other with desire and belief. However, Study 2 provides a more accurate picture of the timing of these onsets and the typical length of delay between self and other reference. Delays between onset of self and other reference for desire and

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belief verbs were typically between 10-12 months. Again these results cannot be explained by a general bias towards talking about the self. As in Study 1, the children predominantly referred to other with perception and action verbs, whereas they almost exclusively referred to self with desire and belief.

The length of delays found in this study are at odds with the shorter delays reported by Bartsch and Wellman (1995). We offer the following three reasons why our results may differ: First, a larger proportion of children in the Bartsch and Wellman study were already using self desire at the onset of study which will necessarily decrease the length of delay between self and other desire by putting the onset of self desire at a later time point. Second, Bartsch and Wellman do not count unembellished uses of "I don't know" as genuine references to mental states. We argue that these uses can be determined from the context to be genuine or not. Since many children's first use of belief was "I don't know", Bartsch and Wellman's procedure would have shortened this delay between self belief and other belief by putting the onset of self belief at a later time point. Third, it appears from our data that there is a small subset of children (10%) who are precocious in their onset of other belief, and it may be possible that this type of child is overrepresented in the Bartsch and Wellman (1995) study.

General Discussion

Looking closely at children's talk about mental states between ages 1 ½ and 3 ½ years reveals clear and intriguing developmental trends in how children master mental state language well before they begin to understand false beliefs. This gives us important information with which to evaluate the current theoretical accounts of how children come to understand the mind. The data reveal problems for both of the current accounts, theory theory and simulation theory.

Children's earliest references to mental states are to perceptions, desires and beliefs. However, in all three cases the developmental data indicate problems for the theory theory

account of how children acquire their knowledge of these states. In the theory theory account, children construct mental state concepts to explain their own and others' behavior. These concepts should then appear in their talk about both their own and others' behavior. However, children talk about self desire much earlier than they talk about other desire and they talk about self belief much earlier than other belief. Finally, the opposite problem occurs in the case of perception. Children talk about other perception much earlier than they talk about self perception. In all three cases, theory theory would have to account for why children would bother to construct a mental state concept that should be equally applicable to self and other, but then only use it to refer to half of the behavior it was designed to explain and neglect to apply it to the other half for up to a year thereafter. Theory theorists have noted the parallels between their account and the development and use of theories in scientific domains, but this would seem to be one instance where the parallel breaks down.

In addition, versions of theory theory (Gopnik & Wellman, 1992) have proposed that children construct concepts of desire and perception at the same time, such that their initial theory is a "perception-desire" theory. The data indicate problems for this version also. References to self desire emerge early as predicted, but references to self perception emerge later at the same time as references to self belief, not at the same time as references to self desire.

The data also indicate problems for simulation theory. The problems are with the aspect of simulation theory that proposes that children have privileged, direct access to their own mental states. As others have pointed out before (Bartsch & Wellman, 1995), simulation theory has offered no principled reason why access should be easier in the case of desires than beliefs, yet the data show children referring to self desires much earlier than to self beliefs. What is new in this regard in the current data is that children refer to others' perceptions well before they refer to their own perceptions, a reversal of what is predicted by simulation theory.

If we take the current findings as showing genuine developmental trends, then we have three acquisitions to explain. In the first stage children acquire the forms for expressing other people's perceptions and their own desires. In the second stage they begin referring to their own perceptions and their own beliefs and others' desires. In the third stage they refer to others' beliefs.

First stage: Self desires and others' perceptions. In the case of self desire, the data imply that these references stem from children's direct access to their own states of desire. The substantial delay between self and other desire argues that references to self desire do not stem from a theoretical construct of desire, in which case references to desire should apply to both self and other. In addition, there was substantial variation in the age at which reference to self desire emerged across the sample for the entire two year period covered in Study 2. Variation in age at onset may reflect individual differences in children's ability to introspect and verbally encode desires. Introspection itself must occur during ongoing action when desires may fluctuate. Furthermore, children have available alternatives to verbally encoding their desires. For example, desired objects can often be gotten directly, by pointing or by naming the desired object.

In the case of others' perceptions, these references would seem to stem from neither direct access (because references to other come in before references to self) nor theoretical construction (because they do not come in simultaneously). Instead the early reference to others' perceptions may be based on a very early ascription of intention to others' behavior. There are at least three aspects of intentionality that young children ascribe to others' behaviors. By 18 months of age children understand that people use words to refer to things (e.g., Baldwin, 1991). They understand that others' behavior is goal-directed (e.g., Meltzoff, 1995). And they understand that others look at things (Bruner, 1983; Baron-Cohen, 1991; Bretherton, 1992). This ascription of

intentionality to others' behavior would allow young children to easily map their own first words for perceptions (e.g., look, see) and actions (e.g., go, do) onto others' behaviors.

Second stage: Self perceptions, self beliefs and others' desires. References to self perceptions and self beliefs appeared not to result from the children's theoretical construction of these two constructs because in neither case was there much evidence for simultaneous appearance of reference to the mental state in others. In the case of their own perceptions the data suggest that it may be difficult for children to introspect on these mental states. At the first stage they referred to others' perceptions and their own desires, thus they already had the linguistic ability to refer to both perceptions and the self, but they did not start referring to their own perceptions until, on average, one year later. This suggests that introspective access to their own perceptions, while eventually achieved by young children, is not an easy or automatic achievement. Introspective access to perceptions may be difficult for young children because their own perceptions are likely to be transparent to them in a way that their desires are not. When children want an object, their desire is an immediate part of the experience in addition to the object itself. But in the case of perception, young children may be more likely to focus on what they are looking at rather than the fact that they are looking at it, and to focus on where something is rather than on whether they see it right now. References to self perceptions appear to arise from direct access to perceptual states, but the introspection required to distinguish these perceptual states from the state-of-affairs also appears to have its own particular source of difficulty when compared to the introspection required fro desires.

The same argument for transparency would seem to apply to children's self beliefs. Young children may be more likely to focus on what they know to be true rather than on the fact that they know it. For example, it is more likely that children would say, "The book is on the table," than "I know the book is on the table." Thus, for both perceptions and beliefs, when children are

connected to the world through those mental states, those states are likely to be transparent to them early in development. In fact many of children's early references to self belief were references to instances when those connections failed (i.e., "I don't know"), perhaps because these instances of failed connections made it easier for children to distinguish the mental state from the state-of-affairs. However, early use of the negative form was not the case for perception verbs conceivably because children had been using the positive form with others' perceptions earlier.

References to others' desires appeared at this same time. The fact that they appeared substantially after references to self desire (and did so on a child-by-child basis) is consistent with simulation theory. However, an average delay of a year between references to self desire and others' desires seems curiously long given that children were referring to others' perceptions a year earlier. It would seem to be a short step to use a process of simulation to go from references to self desire and others' perceptions to references to others' desires (e.g., "Look at the ice cream mommy. I want some.... You want some?"). Although the present data do not speak directly to the issue, the delay may indicate that instead of simulating children are having to construct a concept of desire as a mental state in others. This concept would presumably have the feature of a mental state persisting in the other individual even in the absence of any particular behaviors directed toward the desired object. Evidence that children are constructing a concept of desire as a persistent mental state may be available from future analyses of children's language to determine whether they comment on others' on-going behavior in their references to others' desires or whether they refer to others' potential desires in the absence of others' behavior. Thus, while references to others' perceptions may stem from a specialized system for interpreting others' behavior intentionally, and references to self desires, perceptions, and beliefs may stem from direct access to those states, references to others' desires may represent the first theoretical concept of mental state that children construct.

Third stage: Others' beliefs. The remarks above concerning the developmental basis of references to others' desires apply also to others' beliefs. For the most part the delay between self and other reference here is also substantial, and also curious. Given all the references children are making to their own and others' mental states, it would seem relatively easy for children to simulate and begin referring to others' beliefs (e.g., "See the ice cream mommy? I want some.... You want some? I don't see it. I don't know where it is.... You know where it is?"). Thus the delay may be due to children having to construct a concept of belief as a mental state that can exist in others. An interesting aspect of the acquisition of references to others' beliefs is that a small minority of children were able to use other belief at the same time as or even somewhat earlier than self belief (See Table 8). In future research this subset of children may provide some insight into how references to others' beliefs develop.

In summary, the present studies have shown that aspects of each of the current theories are deficient. Contrary to theory theory there are substantial developmental delays between acquisition of the first person and second person forms for the early mental state verbs, and contrary to simulation theory children not only acquire reference to self desire before self perception and belief but also acquire reference to other perception before self perception. Three central findings that need explaining are: (1) The early references to others' perceptions. Here we have suggested that these are based on children's tendency to interpret others' behavior intentionally. (2) The delay between references to self desire and references to self perceptions and beliefs. Here we have suggested differential difficulty of direct access based on transparency of self perceptions and beliefs. (3) The delay between self desire and other desire, and between self belief and other belief. Here we have suggested that this is could be due to children's having to learn to simulate those states in others, but that the long delays may instead suggest that children are having to construct concepts of desire and belief as mental states in others.

The studies presented in the current paper have provided some clarification of the processes that might be involved in the acquisition of a theory of mind. We suggest that the early language data do show that young children have direct introspective access for self desires, perceptions and beliefs, although this access appears to be easier for desires than for perceptions and beliefs. The present data do not speak as clearly to whether children's later understanding of desires and beliefs in others involves exclusively theory construction or simulation, although further studies of language data may help resolve this question. Nevertheless even simulation would seem to involve some theory use. One reason is that even the process of representing the other's situation is a theory driven process, in that decisions are made about what are the relevant features of the situation to represent. And to the extent that children engage in theorizing about the mind, direct access to mental states in themselves would give children introspective percepts of mental states on which to base an understanding of those states in others. Without introspective percepts children's theorizing would likely be unconstrained. With introspective evidence children's theorizing would have the great advantage of being directed from the beginning toward mental states and processes rather then any number of other possible explanations of human behavior.

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Footnotes

1. An additional level of coding used by Bartsch and Wellman (1995) involved identifying whether or not the use of a mental state verbs was embellished. For example "I want", "I know" or "I don't know" produced alone were considered unembellished productions of mental state verbs (i.e., the sentence did not include a predicate). In study 2, we also coded all desire and belief verbs on this dimension and found that our results did not differ substantially according to whether or not we included unembellished (yet genuine productions as determined by the context) productions of these mental state verbs. For example the average onset for self belief was 35 months if we included only embellished genuine productions and 32.5 months if we included both embellished and unembellished genuine productions. In addition, the inclusion of unembellished genuine productions only affected the relative onset patterns for self and other belief of three children (9%). Two of the children had simultaneous acquisition of self and other belief with embellished productions but self belief before other with unembellished productions. The remaining child switched from other before self belief with embellished to self before other with unembellished.

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Table 1

Background and language characteristics of the sample in Study 1.

	14 months (n = 52)	20 months (n = 48)	32 months (n = 37)
Child Gender (M, F)	26, 26	23, 25	19, 18
Mean Hollingshead Score	53.0	52.9	53.3
Mean MLU	1.13	1.33	2.55

Table 2
Frequency (and proportion) of children's productions of first person singular (Self), first person plural (Joint), and second or third person (Other) forms for verbs of perception, desire, and belief in Study 1.

	Perception			Desire			Belief		
Child Age	Self	Joint	Other	Self	Joint	Other	Self	Joint	Other
14 Months (n = 52)	0	0	1	1	0	0	0	0	0
20 Months (n = 48)	13 (.72) (n=6)	2 (.11) (n=2)	3 (.17) (n=3)	58 (.97) (n=20)	0 (n=2)	2 (.03) (n=3)	3 (1.0)	0	0
32 months (n = 37)	10 (.15) (n=6)	5 (.08) (n=4)	51 (.77) (n=23)	116 (.71) (n=31)	2 (.01) (n=2)	46 (.28) (n=13)	60 (.97) (n=22)	1 (.02) (n=1)	1 (.02) (n=1)

Note: n's signify the total number of children at each age, and the number contributing each form.

Table 3
Children's production of self and other reference for verbs of desire at 20 and 32 mos (n=36) in Study 1.

		32 Months				
		None	Self Only	Other Only	Both	Marginal Totals
20 Months	None	3	12	(a)	7	22
	Self Only	1 (b)	6	(b)	5	12
	Other Only	(a)	(a)	(a)	1 (a)	1
	Both	(b)		(b)	1	1
	Marginal Totals	4	18	0	14	36

Note: Only 36 children had data at both 20 and 32 months.
Cells labeled (a) reflect other desire occurring before self desire
Cells labeled (b) reflect self desire at 20 months but not at 32 months

Table 4

Frequency (and proportion) of children's productions of self, joint and other forms with action verbs in Study 1.

Child Age	Self	Joint	Other
14 Months (n=52)	2 (.20)	0	8 (.80)
20 Months (n=48)	108 (.54)	0	93 (.46)
32 Months (n=37)	241 (.32)	27 (.04)	493 (.65)

Table 5

Frequency (and proportion) of parents' productions of self, joint and other reference forms for verbs of perception, desire, and belief in Study 1.

	Perception			Desire			Belief		
Child Age	Self	Joint	Other	Self	Joint	Other	Self	Joint	Other
14 Months	63 (.02)	129 (.04)	3,012 (.94)	17 (.02)	5 (.01)	827 (.97)	97 (.47)	1 (.01)	107 (.52)
20 Months	91 (.04)	146 (.06)	2,311 (.91)	25 (.02)	6 (.01)	904 (.97)	114 (.36)	0	200 (.64)
32 Months	71 (.05)	157 (.10)	1,290 (.85)	36 (.09)	4 (.01)	369 (.90)	150 (.42)	4 (.01)	204 (.57)

Table 6
Frequency (and proportion) of children's productions of self, joint and other forms for verbs of perception, desire, and belief in Study 2.

	Perception			Desire			Belief		
Child Age	Self	Joint	Other	Self	Joint	Other	Self	Joint	Other
18 months	2 (.03) (n=1)	0	61 (.97) (n=14)	18 (1.0) (n=9)	0	0	0	0	0
21 months	0	0	25 (1.0) (n=14)	21 (1.0) (n=9)	0	0	0	0	0
24 months	4 (.05) (n=4)	0	71 (.95) (n=18)	63 (.94) (n=20)	0	4 (.06) (n=3)	5 (.83) (n=4)	0	1 .17) (n=1)
27 months	5 (.06) (n=5)	0	76 (.94) (n=25)	76 (.94) (n=21)	0	5 (.06) (n=4)	8 (.89) (n=7)	0	1 (.11) (n=1)
30 months	15 (.15) (n=11)	0	85 (.85) (n=26)	148 (.91) (n=25)	1 (.01) (n=1)	13 (.08) (n=7)	17 (.89) (n=9)	0	2 (.11) (n=1)
33 months	11 (.14) (n=10)	0	70 (.86) (n=22)	160 (.92) (n=25)	1 (.01) (n=1)	13 (.07) (n=8)	24 (.83) (n=11)	0	5 (.17) (n=2)
36 months	8 (.10) (n=8)	2 (.02) (n=2)	71 (.88) (n=27)	182 (.83) (n=29)	2 (.01) (n=2)	35 (.16) (n=13)	19 (.95) (n=13)	0	1 (.05) (n=1)
39 months	13 (.13) (n=7)	0	89 (.87) (n=23)	123 (.83) (n=29)	4 (.03) (n=4)	22 (.15) (n=11)	32 (.80) (n=16)	0	8 (.20) (n=6)
42 months	10 (.08) (n=9)	6 (.05) (n=6)	103 (.87) (n=27)	129 (.83) (n=26)	3 (.02) (n=2)	24 (.15) (n=14)	52 (.83) (n=18)	0	11 (.17) (n=7)

Note: n's signify the number of children contributing each form. Total N=32.

Table 7
Patterns of onset for self and other reference with verbs of desire in Study 2.

	Number of Children	Percentage of children
Reversal (other before self)	0	
Simultaneous	0	
Self desire 3 mos before other desire	3 (1)	9%
Self desire 6-9 mos before other desire	8 (2)	25%
Self desire 12-15 mos before other desire	9 (2)	28%
Self desire 18-21 mos before other desire	5 (2)	16%
No reference to other desire by 42 mos	7	22%

Note: Estimated minimum delay for the 7 children who had not referred to other desire by 42 months in parentheses

Table 8
Patterns of onset for self and other reference with verbs of belief in Study 2.

	Number of Children	Percentage of children
Reversal (other before self)	3	9%
Simultaneous	1	3%
Self belief 3 mos before other belief	3 (2)	9%
Self belief 6-9 mos before other belief	5 (6)	16%
Self belief 12-15 mos before other belief	1 (2)	3%
Self belief 18-21 mos before other belief	1 (4)	3%
No reference to other belief by 42 mos	14	44%

Note: Four children (13%) showed no belief vocabulary.

Estimated minimum delay for the 14 children who had not referred to other belief by 42 months in parentheses.

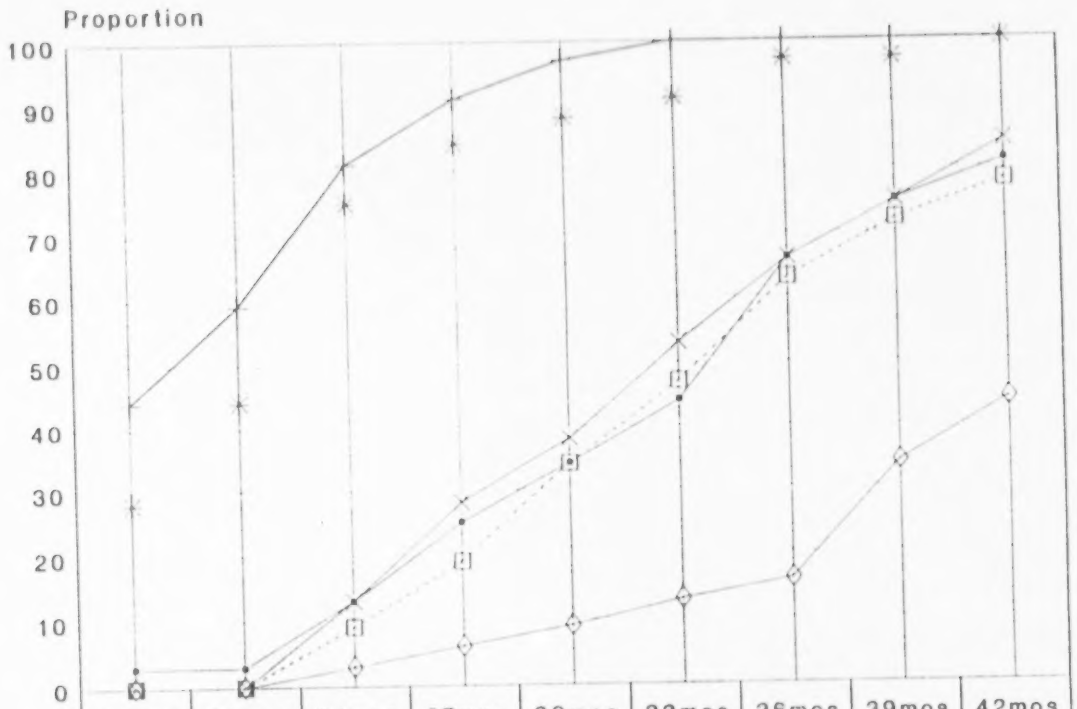
Table 9

Frequency (and proportion) of children's productions of self, joint and other forms with action verbs in Study 2.

Child Age	Self	Joint	Other
18-24 mos	74 (.27)	0	201 (.73)
27-33 mos	344 (.38)	19 (.02)	543 (.60)
36-42 mos	441 (.35)	39 (.03)	768 (.64)

Figure Captions

Figure 1: Cumulative proportion of children using verbs of perception, desire and belief in reference to self and other in Study 2.



	18mos	21mos	24mos	27mos	30mos	33mos	36mos	39mos	42mos
Self Perception	3	3	13	25	34	44	66	75	81
Other Perception	44	59	81	91	97	100	100	100	100
Self Desire	28	44	75	84	88	91	97	97	100
Other Desire	0	0	9	19	34	47	63	72	78
Self Belief	0	0	13	28	38	53	66	75	84
Other Belief	0	0	3	6	9	13	16	34	44

Percentage of children at each age

APPENDIX A

Verbs of desire:	Verbs of belief:
afraid (that)	believe
care (about)	dream
need*	expect
want	feel*
wish	forget*
hope	guess*
	know
	remember*
	think
	wonder

*Verbs not included by Bartsch and Wellman (1995).

APPENDIX B

Action verbs:	Perception verbs:
be	look*
break	see*
catch	
close	
color	
come	
crayon	
do*	
draw	
drive	
eat	
get	
go*	
have	
help	
hide	
hurt	
let	
make	
open	
play	
push	
put*	
read	
ride	
say	
sit	
sleep	
take	
use	
wash	
write	

* Five verbs used in both Study 1 and Study 2 (all other verbs were used in Study 1 only).

APPENDIX C

Manual for coding mental state verbs

The following is a system for adding "postcodes" to CHILDES (Child Language Data Exchange System) files of parent-child interaction in order to:

1) identify genuine (unambiguous) references to mental states,

2) code referent (i.e. self, joint or other) referenced by mental state verbs and action verbs

The transcripts of the data are based on windows surrounding the target verb. Each window generally consists of 8 utterances: 4 before the target and 3 after the target (exceptions are at the start or end of a situation when preceding/following utterances may be fewer than 4 or 3 respectively). Typically the target verb is in the FIFTH utterance.

Level One: Identifying Genuine References to Mental States

The first level of coding determines whether a mental state verb is used to genuinely refer to a mental state or is left unembellished, is used conversationally, in repetition of another's or one's own prior utterance, or refers to ongoing physical actions not mental behavior.

Step One:

Locate the target utterance in the window (check that the utterance contains a verb from the appended lists of mental state and action verbs. It should also match the given KEYWORD at the start of the window. In the example below the target verb is WANT.

Step Two:

Code the target verb as belonging to one of the following mutually exclusive categories by placing postcode on same line as target utterance after all sentence delimiters (e.g. period, question mark, exclamation mark). The example below,

[+ conv] Speaker's use of verb has a conversational function:
i) get someone's attention (e.g. You know what?)
ii) turn conversation over to another (e.g. Time to eat. What do you think?)
iii) soften request/demand (e.g. I wonder, can we have pizza instead?)

[+ rep] Speaker's use of verb is direct repetition of another's prior utterance (e.g. Mother: I want to eat. Child: I want to eat), or self repetition (e.g. I want to, I want to), in which case only first instance is genuine all others are repetitions.

[+ behav] Speaker's use of verb refers to actions as they occur rather than unambiguously to mental state process (e.g. I remembered my coat [as coat is being put on]).

[+ unemb] Speaker's use of verb is unembellished (e.g. I know, I don't know, I want etc followed by no further elaboration).

[+ gen] Remaining uses of a mental state verb functioning as unambiguous references to mental state processes.

Level Two: Referent Coding

This level of coding determines whose mental state (or actions) the speaker is referring to - his/her own or someone elses.

Step One:

Code only action verbs or those mental state verbs that have been identified at Level One as genuine or unembellished instances of mental states.

Step Two:

Code the target verb as belonging to one of the following mutually exclusive categories by placing postcode on same line as target utterance after all sentence delimiters.

[+ self prn] Speaker's use of the verb refers to the self signaled by use of a first person singular pronoun (e.g. I want, me want, my want).

[+ self cxt] Speaker's use of the verb refers to self signaled by the context of all speakers' utterances and all provided commentary (e.g. %exp [explanation], %add [addressee]).

[+ other prn] Speaker's use of the verb refers to other(s): signaled by use of a second or third person pronoun (e.g. You want, She wants, They want).

[+ other cxt] Speaker's use of the verb refers to other(s): signaled by the context of all speakers' utterances and all provided commentary.

[+ self&other prn] Speaker's use of the verb refers to self and other(s): signaled by use of a first person plural pronoun (e.g. We want, Us want it).

[+ self&other cxt] Speaker's use of the verb refers to self and other(s): signaled by the context of all speakers' utterances and all provided commentary.

[+ ambig] Speaker's use of the verb is not accompanied by a personal pronoun for self, other or self & other and cannot be coded from contextual material alone.

Example for target verb want, with postcodes for genuine self pronoun.

*REB: Mummy [=! vocative] where did you find all those Mummy [=! vocative] ?
*MOT: we found them down here on the floor [unintelligible segment].
*CHI: Mum [=! vocative] .
*MOT: <Hello .> [>]
*CHI: <I want> [<] my glasses. [+ gen][+ self prn]
%com: toy rabbit wears glasses
*MOT: there's your glasses .
*MOT: there you are .
*MOT: [unintelligible].